

REMARKS

The Office Action mailed March 21, 2006, has been received and reviewed. Claims 1 through 16 and 19 are currently pending in the application. Claims 1 through 16 and 19 stand rejected. Applicants have amended claims 1 and 2 and respectfully request reconsideration of the application as amended herein.

35 U.S.C. § 112 Claim Rejections

Claims 1 through 16 and 19 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Applicants respectfully traverse this rejection, as hereinafter set forth.

Claims 1 and 2 have been amended to delete limitations relating to the encapsulant material to be subsequently applied to the intermediate structure. Applicants assert that claims 1 and 2, as presented herein, clearly pertain to intermediate structures and not to the subsequent structures resulting from an encapsulation process. Therefore, withdrawal of the rejection to claims 1 through 16 and 19 under the second paragraph of 35 U.S.C. § 112 is respectfully requested.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,677,566 to King et al. in view of U.S. Publication No. 2001/0011773 to Havens et al.

Claims 1, 2, 5 through 9, 13 through 16, and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over King et al. (U.S. Patent No. 5,677,566) in view of Havens et al. (U.S. Publication No. 2001/0011773, now U.S. Patent No. 6,351,030). Applicants respectfully traverse this rejection, as hereinafter set forth.

Applicants respectfully assert that claims 1, 2, 5 through 9, 13 through 16, and 19 could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering King et al. in view of Havens et al. because King et al. and Havens et al., when combined, do not teach or suggest an intermediate structure comprising "at least one carrier bond

... [attached to or disposed on] the upper surface of [a] conductive lead frame member,” and “wherein the intermediate structure is free of an encapsulant material to be subsequently applied to the intermediate structure,” as recited in each of independent claims 1 and 2.

As a preliminary matter, Applicants note that when determining whether a claimed invention would have been obvious in view of teachings of the prior art, it must be determined whether the claimed invention as a whole would have been obvious to one of ordinary skill in the art considering the teachings of the prior art references as a whole. See MPEP § 2141(II). Applicants respectfully assert that the claimed invention as a whole would not have been obvious to one of ordinary skill in the art considering the combined teachings of the cited prior art references as a whole for reasons set forth below.

Havens et al. teaches “covering substantially all of the external surfaces of an electronic package, with the exception of a portion of the conductors that are required for electrically coupling to an external substrate, with an essentially hermetic covering which is highly hydrophobic.” *Havens et al.*, Page 2, Paragraph [0025]. This is done to improve the resistance to moisture damage relative to previous covers (encapsulant materials), which are allegedly “particularly susceptible to moisture due to the hydrophilic nature of resins such as epoxies....” *Id.*, Page 1, Paragraph [0002]. Havens et al. further teaches that the hydrophobic covering 23 may include “amorphous fluoropolymers,” “fluorinated parylene,” or “standard parylene-C type coatings.” *Id.*, Page 3, Paragraphs [0034], [0037]. Havens et al. further teaches that the hydrophobic coverings 23 may be applied by immersing the semiconductor device into a solution (*see* Page 2, Paragraph [0028]), by spraying the covering onto the device (*see* Page 3, Paragraphs [0035]-[0036]), by brushing the covering onto the device (*see* Page 3, Paragraphs [0035]), or by chemical vapor deposition (*see* Page 3, Paragraphs [0035], [0037]).

King et al. teaches a semiconductor chip package 10 that includes an encapsulating material 26. *King et al.*, column 3, lines 9-56. A method of fabricating the semiconductor chip package 10 is taught by King et al. with reference to FIGS. 6-8. *Id.*, column 4, lines 13-65. The method involves forming an intermediate structure shown in FIG. 7. The intermediate structure shown in FIG. 7 does not include “at least one carrier bond [attached to or disposed on] the upper surface of [a] conductive lead frame member,” as recited in independent claims 1 and 2.

Furthermore, the intermediate structure shown in FIG. 7 is not “free of an encapsulant material to be subsequently applied to the intermediate structure,” as also recited in independent claims 1 and 2. In contrast, the intermediate structure shown in FIG. 7 of King et al. includes encapsulating material 26, and external electrodes 28 (solder balls) are formed on the conductive leads 12 after forming the encapsulating material 26, as shown in FIG. 8. *King et al.*, column 4, lines 36-51.

King et al. teaches that the encapsulating material 26 is typically a “thermosetting epoxy resin.” *King et al.*, column 4, lines 36-38. As Havens et al. teaches that epoxy resins are hydrophilic and susceptible to moisture damage, Applicants admit that one of ordinary skill in the art might have been motivated to replace the encapsulating material 26 in the semiconductor chip package 10 taught by King et al. with a hydrophobic covering 23 taught by Havens et al., and to apply the hydrophobic covering 23 taught by Havens et al. by one of the processes described therein (i.e., immersion, spraying, brushing, or chemical vapor deposition).

Applicants respectfully assert, however, that one of ordinary skill in the art would not have been motivated to further modify the process taught by King et al. so as to form the external electrodes 28 (solder balls) prior to forming the hydrophobic covering 23 taught by Havens et al. because Havens et al. teaches, with reference to FIGS. 9-10, that **the hydrophobic covering 23 can be applied prior to forming the external electrodes 6 (solder balls)**, and Havens et al. **does not teach or suggest the desirability of forming the external electrodes 6 (solder balls) prior to forming the hydrophobic covering 23** so as to provide an intermediate structure as recited in either of independent claims 1 and 2. *See e.g.*, MPEP § 2143.01. In other words, Applicants respectfully assert that one of ordinary skill in the art, considering the teachings of King et al. in view of Havens et al., would have been motivated to form the protective coating 23 taught by Havens et al. prior to forming the external electrodes 28 of the semiconductor device package 10 taught by King et al., because such a method is in accordance with both the method taught by King et al. and the method taught by Havens et al. with reference to FIGS. 8-9.

Since Havens et al. does not teach or suggest the desirability of forming the external electrodes 6 (solder balls) prior to forming the hydrophobic covering 23, King et al. and Havens et al., when combined, clearly cannot be said to teach or suggest replacing the encapsulating

material 26 taught by King et al. with a hydrophobic covering 23 as taught by Havens et al., and forming the external electrodes 28 taught by King et al. prior to forming the hydrophobic covering 23, so as to provide an intermediate structure as recited in either of independent claims 1 and 2.

The Examiner notes at Page 8 of the outstanding Office Action that Havens et al. teaches, at Paragraphs [0025] – [0026], that providing a hydrophilic covering on a semiconductor device as disclosed therein allows the package to be subsequently sealed without moisture, thus improving the reliability and product yield. Applicants respectfully assert that Havens et al. does not teach or suggest that forming the external electrodes 6 (solder balls) prior to forming the hydrophobic covering 23, as taught at Paragraphs [0028] – [0029], improves the reliability and product yield relative to processes in which the external electrodes 6 (solder balls) are formed after forming the hydrophobic covering 23, as taught at Paragraphs [0057] – [0058].

The Examiner also asserts at Page 8 of the outstanding Office Action that “[b]y forming the balls first as Havens does and then forming the encapsulant last, process steps can be eliminated and the package can be formed efficiently and quickly. Applicants respectfully assert that forming a hydrophobic covering 23 as described at Paragraphs [0028] – [0029], and shown in FIGS. 1, 1A, and 1B requires the use of tape 7, and also may require equipment for precisely depressing the solder balls 6 into the tape 7 by a precise distance (as shown in FIG. 1A) so as to provide a required exposed area on the surface of the solder balls 6. Furthermore, additional equipment may be required to handle the tape 7 and the packages attached to the tape 7, as well as equipment for detecting the depth to which the packages are immersed within the solution 2. There is no evidence that such a process would allow the package to be formed more “efficiently and quickly” relative to other processes such as, for example, immersing an entire structure in the solution to form a protective covering 23 and subsequently etching (using, for example, a photolithography process or a laser etch process) holes in which solder balls may be subsequently formed, as asserted by the Examiner.

In view of the above, there is simply no motivation in the cited references to form the external electrodes 28 taught by King et al. prior to forming the hydrophobic covering 23 taught

by Havens et al., so as to provide an intermediate structure as recited in either of independent claims 1 and 2.

As King et al. and Havens et al., when combined, do not teach or suggest an intermediate structure as recited in either of independent claims 1 and 2 as currently amended, Applicants respectfully assert that independent claims 1 and 2 could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering King et al. in view of Havens et al., and request that the Examiner withdraw the rejection of independent claims 1 and 2 under 35 U.S.C. § 103(a).

Furthermore, the nonobviousness of independent claim 2 precludes a rejection of claims 5 through 9, 13 through 16, and 19, which depend from claim 2, because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to claims 5 through 9, 13 through 16, and 19, in addition to the rejection to independent claim 2.

Regarding dependent claim 14, Applicants respectfully assert that the teachings of King et al., considered together with the teachings of Havens et al., do not teach or suggest carrier bonds that comprise a conductive or conductor-filled polymer, as recited therein. Therefore, Applicants respectfully assert that dependent claim 14 could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering King et al. in view of Havens et al., and request that the Examiner withdraw the rejection of dependent claim 14 under 35 U.S.C. § 103(a) for this additional reason.

Obviousness Rejection Based on U.S. Patent No. 5,677,566 to King et al. in view of U.S. Publication No. 2001/0011773 to Havens et al. as applied to claims 2 and 9 above and further in view of U.S. Patent No. 5,894,107 to Lee et al.

Claims 3, 4, and 10 through 12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over King et al. (U.S. Patent No. 5,677,566) in view of Havens et al. (U.S. Publication No. 2001/0011773) as applied to claims 2 and 9 above and further in view of Lee et

al. (U.S. Patent No. 5,894,107). Applicants respectfully traverse this rejection, as hereinafter set forth.

Each of claims 3, 4 and 10 through 12 depends either directly or indirectly from independent claim 2, and as a result, each includes the limitations recited in independent claim 2. Applicants assert that none of claims 3, 4 and 10 through 12 could have been obvious under 35 U.S.C. § 103(a) at the time the invention was made because the cited references, when combined, do not teach or suggest teach or suggest all the claim limitations found in independent claim 2, as currently amended, from which each of claims 3, 4 and 10 through 12 depends.

As previously discussed, King et al. and Havens et al., when combined, do not teach or suggest an intermediate structure comprising “at least one carrier bond ... [attached to or disposed on] the upper surface of [a] conductive lead frame member,” and “wherein the intermediate structure is free of an encapsulant material to be subsequently applied to the intermediate structure,” as recited in independent claim 2 as currently amended. The teachings of Lee et al. do not satisfy the deficiency.

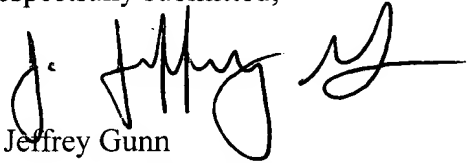
Lee et al. teaches encapsulating a chip and lead frame assembly and **subsequently** providing a plurality of carrier bonds in the form of solder balls 16 on exposed upper surfaces of external connection means 34. *Lee et al.*, column 5, lines 20-29, and 39-43; FIGS. 11-12.

As King et al., Havens et al., and Lee et al., when combined, do not teach or suggest an intermediate structure comprising “at least one carrier bond ... [attached to or disposed on] the upper surface of [a] conductive lead frame member,” and “wherein the intermediate structure is free of an encapsulant material to be subsequently applied to the intermediate structure,” as recited in independent claim 2 as currently amended, Applicants respectfully assert that none of claims 3, 4 and 10 through 12 could have been obvious to a person of ordinary skill in the art at the time the invention was made considering King et al. in view of Havens et al., and further in view of Lee et al., and request that the Examiner withdraw the rejection of dependent claims 3, 4 and 10 through 12 under 35 U.S.C. § 103(a).

CONCLUSION

Claims 1 through 16 and 19 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,

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